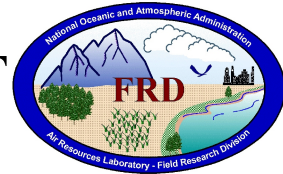


FRD ACTIVITIES REPORT

February 2007



Research Programs

UrbaNet

The manuscript "Analysis of Plume Dispersion, Decay, and Peak-to-Mean Excursions for Continuous Tracer Gas Releases in an Urban Core, Oklahoma City, JU03" has returned from an internal ARL review. We are presently editing the draft in response to reviewer comments in preparation for journal submission. The manuscript "Analysis of Plume Dispersion in a Nocturnal Urban Boundary Layer in Complex Terrain, Salt Lake City, URBAN 2000" has completed internal FRD review and will require minor editing before submission for ARL review.

Some results of a particularly interesting nocturnal tracer field experiment included in the URBAN 2000 manuscript are shown in Figures 1-3. These three figures represent tracer concentrations during three consecutive half hour periods from 0100 to 0230 MST covering the hour long tracer release period and the subsequent half hour. The triangles denote fixed samplers located on 1-, 2-, and 4-km arcs nominally downwind of downtown and the release site (black "X"). Concentrations at these samplers are keyed to the 0-500 pptv legend. The other symbols (circles, diamonds, and squares) denote fixed samplers located in the downtown area with concentrations keyed to the 0-10,000 pptv legend. The colored lines represent mobile sampler traverses occurring during the half hour period and are indicated on the map with concentrations keyed to the 0-10,000 pptv legend.

In this complex terrain setting, nocturnal drainage flows were very common and often dominated plume dispersion. This was seen in the first half hour (Fig. 1). Despite the observed winds blowing in very different directions, the plume initially tracked down-

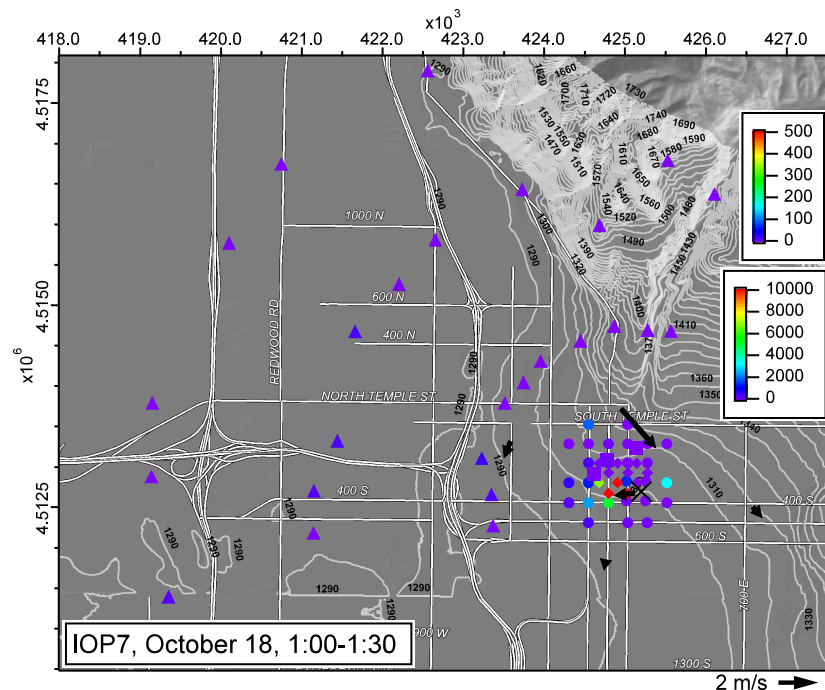


Figure 1. Tracer concentration footprints during IOP 7 of the 2000 field project. Data are from October 18, 2000 during 0100-0130 MST.

valley toward the west and northwest as would be commonly expected in these conditions. During the second half hour of the release period (Fig. 2), the plume continued to pass through the downtown area toward the northwest. However, there was nothing in the available wind observations to support this direction of plume transport. In the figure, which represents the first half hour after the release was turned off (Fig. 3), there were even more anomalous observations. The local winds in the downtown area were well organized and easterly by this time suggesting any remaining tracer should have been transported toward the west. In fact, the tracer plume was centered near the release site at concentrations greater than those observed during the actual release period. Doubly confounding is the observation of high tracer concentrations by the mobile samplers over a half kilometer away toward the east in an apparently upwind direction. The only hint to explain these anomalous observations is the lone weak westerly wind observation made with a sonic anemometer located near the release site.

This particular experiment highlights the great difficulties that can be realized in trying to reliably anticipate and model urban plume dispersion. A very dense meteorological network would have been required to have satisfactorily defined the flows that actually drove the dispersion. It is also apparent that

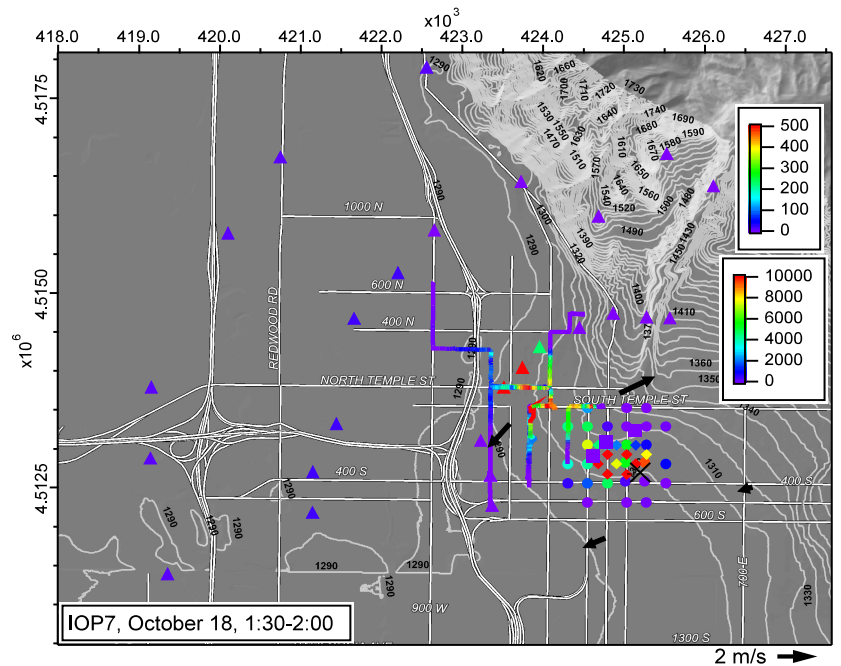


Figure 2. As in Fig. 1 for 0130-0200 MDT, illustrating tracer plume transport down-valley, contrary to the observed wind field.

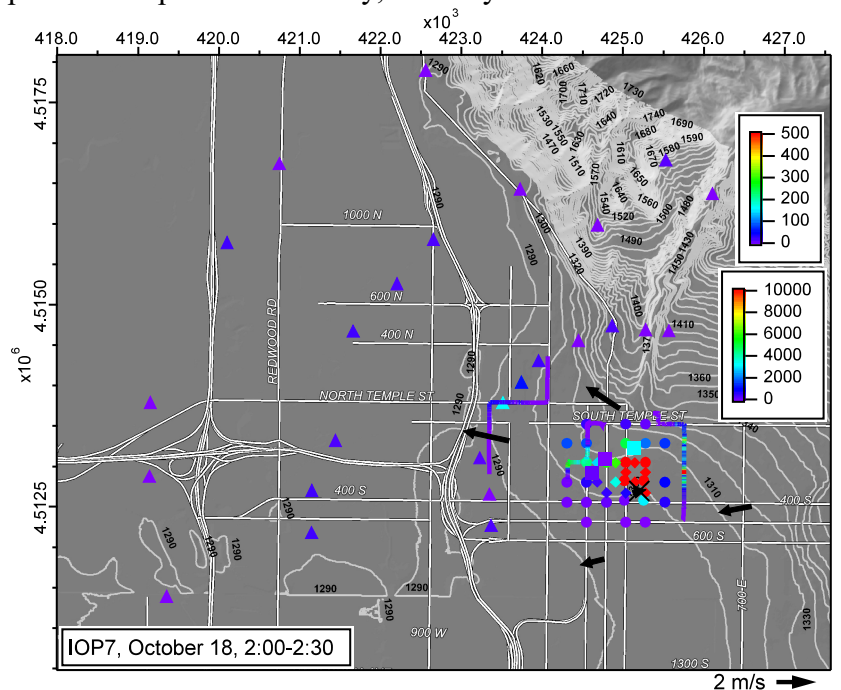


Figure 3. As in Fig. 1 for 0200-0230 MDT, illustrating tracer transport up-valley and apparently upwind.

attempting to reliably anticipate or model an urban dispersion event such as this would be impossible without a dense meteorological network and/or tracer studies to identify such anomalies. (Dennis Finn, 208-526-0566)

Urban Dispersion Program

A NOAA tech memo describing FRD's involvement in the NYC Urban Dispersion Program's August 2005 Midtown Manhattan field study was returned from ARL review. We are currently in the process of making final editorial changes based on reviewer comments and it should be ready for printing very soon. However, due to the sensitive information within the document, we will publicly limit the distribution of the document until final approval for public distribution is received from DHS and NYC officials. This document will be beneficial to emergency personnel and to the public if there is an accidental or intentional release of a chemical, radiological, or biological agent in an urban environment. (Kirk L. Clawson, 208-526-2742, Jason Rich, and Dennis Finn)

Smart Balloon

Testing has been completed on the improved motor and gearbox on the smart balloon cut-down mechanism. The motor and gearbox which actuate the two large pinch valves were tested to see how long it would take to fail. The motor and gearbox combination were capable of over ten thousand actuation cycles prior to failure. Since a typical balloon flight of a few days would possibly involve as many as a few hundred actuation cycles, the new motor and gearbox should perform just fine. Details on location of the new valve within the transponder enclosure will need to be worked out prior to any future project. (Randy Johnson, 208-526-2129, and Shane Beard)

Perfluorocarbon Tracer Analysis Development

The long-term PFC sample stability (aging) tests continued. Presently we have low (250 pptv), middle (4,000 pptv), and high concentration (100,000 pptv) aging studies in progress, each represented by six sample cartridges (72 sample bags). While each of these cartridge sets will be analyzed intermittently for several more months, the preliminary indications are that the concentrations in the sample bags are maintaining their original concentrations. On an operational note, we are finding common patterns to the drift in response (calibration) noted last month. During the first few hours of an analysis day, the response to PDCB tends to increase while the response to mPDCH tends to decrease. The shifts in response, often in the range of 10-20%, often require frequent recalibration after the analysis is begun each day. The PMCH response tends to stabilize much more quickly and drift is much less common although recalibration is occasionally needed. After several hours of operation, the drift in response for all species is much slower or negligible. (Dennis Finn, 208-526-0566)

Tracer Sampling and Analysis Upgrade

As part of our continuing efforts to maintain a high quality tracer analysis capability, we are upgrading all of our tracer samplers to new weatherproof enclosures (Fig. 4). A number of the upgraded samplers have been tested to verify that the new enclosures did not cause problems with repeatability, entrapment of tracer within the enclosure, contamination of the quality control samples, and other problems. The results showed that there were no problems with the upgraded samplers. Approximately 70 samplers have been upgraded to the new enclosures.



Figure 4. New FRD weatherproof tracer sampler.

When the samplers were first designed 19 years ago, a state-of-the-art single chip microcontroller was selected to control all aspects of sampler operation. This allowed operator programming or configuration of the sampler operating parameters with a small, simple to use, and inexpensive handheld downloader. A very efficient and inexpensive switching power supply integrated circuit was also designed into the sampler which would allow the sampler to run for weeks at a time using a single 1.5 volt alkaline “D” cell battery. Both of these circuits are now out of production and unavailable from the manufacturers or normal distribution. Since the samplers have been very reliable and have proven to work well over the years, we have determined to maintain the current design if possible, by locating distributors that maintain an inventory of discontinued parts. We have located and received replacement parts for the power supply. The microcontroller has been located and shipped but not yet received. This should allow us to keep sufficient spares on hand for the foreseeable future.

As part of the same effort, we are also upgrading the valves used inside the tracer gas analyzers to a cleaner, zero dead volume design. These new valves should reduce contamination problems and allow a corresponding reduction in time spent purging the autosampler manifold between samples. The valve installation should be completed during the coming month. (Roger Carter, 208-526-2745, Randy Johnson, Dennis Finn, and Shane Beard)

Cooperative Research with DOE NE-ID (Idaho National Laboratory)

Emergency Operations Center (EOC)

For the second time this year, the INL alternate EOC was the location for a requalification drill for FRD personnel. Team C attended this drill during the afternoon of 24 February. As was the case for the first drill, this drill involved an explosion and possible release of biological material from a lab at the IRC in Idaho Falls. The NOAA team operated the MDIFF transport and dispersion model that provided a concentration footprint map for evacuation support. (Roger Carter, 208-526-2745, and Neil Hukari)

Mesoscale Modeling

The latest version of the Weather Research and Forecast (WRF) Model (ARW v 2.2) has been installed at FRD and is undergoing testing as an eventual replacement for the current MM5 model. WRF has been configured with two grids at FRD: a primary grid with 20 km horizontal grid spacing and a nested 4 km grid centered over the region surrounding INL. This version of WRF has a couple of significant improvements. First, the new WRF Preprocessing System (WPS) seems to be much easier to use than previous procedures for initializing the model. Second, the model now handles GRIB2 files much better. Most of the NCEP model outputs are now in GRIB2 format, and these files are typically half the size of the earlier GRIB1 files. Currently, the WRF runs at FRD are being initialized with output from the NCEP Rapid Update Cycle (RUC) model. It is hoped that the hourly restarts of the RUC model will improve the short-range forecasts produced by the local WRF model, particularly wind forecasts needed for dispersion modeling at INL. (Richard Eckman, 208-526-2740)

StormReady

The National Weather Service (NWS) StormReady designation for INL is up for renewal by the NWS. The StormReady designation (see <http://www.stormready.noaa.gov/>), which must be renewed every three years, was originally received by the INL three years ago without input from FRD. However, as a part of the renewal process, FRD has been directly involved and has participated in editing the renewal document. As an additional part of the renewal process, Kirk Clawson and Vernon Preston, the Warning Communication Meteorologist from the Pocatello NWS, provided weather spotter training to the INL Emergency Management on February 22. (Kirk Clawson, 208-526-2742)

Other Activities

Papers

Eckman, R.M., R.J. Dobosy, D.L. Auble, T.W. Strong, T.L. Crawford: A pressure-sphere anemometer for measuring turbulence and fluxes in hurricanes, 2007: *Journal of Atmospheric and Oceanic Technology*. (In press)

Clawson, K.L., R.G. Carter, D.J. Lacroix, J.D. Rich, N.F. Hukari, R.C. Johnson, and T. Strong: Midtown Manhattan 2005 (MID05) SF₆ Atmospheric Tracer Field Tests. NOAA Technical Memorandum OAR ARL-xxx, Air Resources Laboratory, Idaho Falls, Idaho. (Completed ARL review)

Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich, C. Biltoft, K.J. Allwine, J.E. Flaherty, and M.J. Leach, 2007: Analysis of Plume Dispersion, Decay, and Peak-to-Mean Excursions for Continuous Tracer Gas Releases in an Urban Core, Oklahoma City, JU2003. (Completed ARL review)

Carter, R.G., N.F. Hukari, and J.D. Rich: Identifying Natural Clusters in Eastern Idaho Wind Fields: A Practical Application of Cluster Analysis to Wind Forecasting. (ARL review)

Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich, K.J. Allwine, and J.E. Flaherty, 2007: Analysis of Plume Dispersion in a Nocturnal Urban Boundary Layer in Complex Terrain, Salt Lake City, URBAN 2000. (Completed FRD review)

Safety

The safety video recording “Ergonomics & Video Display Terminal” was viewed by all employees at February Staff Meeting.

Training

Donna Harris completed Passport Training at the Willow Creek Building on February 20th. Passport is the INL online service/supply ordering system.

Personnel

Our new administrative assistant Donna Mills, became Donna Harris when she wed Jim Harris on February 21st. Congratulations to both Donna and Jim!